Willingness to be financially informed and the benefits of nudging investors to do so

Remo Stössel[1]

Department of Banking and Finance

University of Zurich

Abstract

Bhattacharya et al. (2012) shows that many investors are reluctant to accept and follow financial advice. This study analyzes three possibilities which could cause this misbehavior: non-monetary costs, willingness to become informed and comprehensibility of financial information. As so many investors do not accept financial advice, the study further analyzes if it is beneficial to nudge investors to do what is good for them (i.e. a risk profiling task). In order to improve the comprehensibility of financial information, the study further tests if different kinds of investors prefer different kinds of risk description formats. The results show that non-monetary costs and the comprehensibility of financial information are not the reasons why so many investors are reluctant to become informed investors. Moreover, nudging investors to do what is good for them is especially beneficial for investors who are intrinsically insufficiently motivated to become informed and who are financially unexperienced. Last but not least, the data clearly shows that different kinds of investors prefer different kinds of risk description formats.

Key Words: financial advice, financial information, experience sampling, risk communication, risk description formats, clickstream data, risk tolerance, financial experience, effort, mandatory risk profiling task, risk taking behavior

JEL-classification: D14, G11, G24, G28

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[1] Department of Banking and Finance, University of Zurich, Plattenstrasse 32, 8032 Zürich, Switzerland

1 Introduction

The literature shows that many households and retail investors make inefficient investment decisions[2]. Financial information and advice offered by professionals are important tools to help investors identify their optimal asset allocation and to reduce their inefficient investment decisions.[3] However, financial advisors do not always act in the best interest of their clients. For example, information asymmetries and varying fee structures between products may lead financial advisors to offer biased advice in order to sell their own financial products, although they know that another firm's product would better suits the client's needs (Fischer & Gerhardt (2007), Bolton et al. (2007)). Market reforms like the Dodd-Frank Act in the United States or the Market in Financial Instruments Directive (MiFID) in the European Union should help elevate the effects of advice fraught with conflicts of interest by providing investors with free, unbiased, and easily understood financial information and advice. Investors should therefore be able to make better investment decisions, for example to invest more in risky assets and hold better diversified portfolios. However, Bhattacharya et al. (2012) shows that many investors are reluctant to accept and follow financial advice, even when it is free and unbiased.

In this study I suggest that a lack of willingness to become informed in the first place, may be a precursor to not accepting advice. In other words, an underlying willingness to become informed may be necessary to be additionally willing to accept advice. I analyse three possibilities which could cause the misbehavior of not following advice: non-monetary costs, willingness to become informed and comprehensibility of financial information. In this study financial information is provided (and not advice). This design isolates the effect of willingness to become informed, and ensures that after reading the financial information no additional future non-monetary costs arise (e.g. implementing the recommended trades).

The participants are financially incentivized to make an informed decision, and are offered information which is: very easy to access (clicking on a link), free, causes no further non-monetary costs, and unbiased. The information is also offered in three different description formats, increasing the comprehensibility. The study tests whether different kinds of investors prefer different kinds of risk description formats. The study further analyzes if it is beneficial to nudge investors who are unwilling to become informed to do what is good for them, for example by using a risk profiling tasks such as experience sampling. This paper uses data from the same study as Bachmann et al. (2014) to answer the research questions herein.

[2] See for example Bachmann and Hens (2015), Bhattacharya et al. (2012), and Calcagno and Monticone (2015).

[3] Expanding financial education, providing investment default options, consumer regulation and disclosure rules are further possibilities to reduce the occurrence and welfare costs of inefficient investment decisions (Campbell (2006)). Market reforms like the Dodd-Frank Act in the United States or the Market in Financial Instruments Directive in the European Union show that the consumer regulation and disclosure rules have become more and more popular during the last years.

The results of this study strongly indicate that many investors are reluctant to willingly become informed, although the above listed criteria (e.g. no monetary or non-monetary costs, unbiased information, etc…) are satisfied. More than half of the participants do not access the information. Thus, the results clearly show that non-monetary costs and difficulty to comprehend the information are not the reasons why so many do not willingly become informed investors.

A comparison between participants who choose to access the information, and those who do not, shows that participants who do not access the information invest less of their financial wealth into risky assets (i.e. they have a lower risk tolerance), have less financial experience, and exert significantly less effort to complete risk profiling tasks and to think about their investment decisions. With regard to these findings, the former group is referred to as attentive and the latter group non-attentive investors. Similar to the findings of Bhattacharya et al. (2012), Calcagno & Monticone (2015) and Bachmann & Hens (2015), the differences between the attentive and non-attentive investors in this study indicate that investors who would benefit most from financial information (or advice) are the least likely to obtain it.[4]

The analysis of the mandatory experience sampling task further shows that such a task which reduces the subjective ambiguity (i.e. to get a better feeling for the return distribution) is especially beneficial for non-attentive investors to improve their investment decisions (an improvement is defined as an increased allocation to the risky asset[5]). In particular the non-attentive investors sustainably increased their investment in the risky asset after completing the experience sampling task. These results suggest that after nudging non-attentive investors to do what is good for them, they change their behavior accordingly. In the case of the attentive investors, the mandatory experience sampling task is much less effective. It only increases their risk tolerance for a very short time. As the results further show, attentive investors follow some simple heuristics to make their investment decision. In particular, they have a preconception about how much they want to invest into the risky assets which is most probably based on their past experience. The preconception is like an anchor from which they hardly deviate. This observation may also explain why the mandatory experience sampling task cannot sustainably change their investment behavior.

Last but not least the study shows that different investors prefer different risk description formats. While the financially experienced and risk tolerant investors prefer the verbal risk description format (with frequency information, e.g. 1 out of 100), the less financially experienced and risk tolerant

[4] Similar results are found in medicine. For example, the so-called illness iceberg and trivia symptom describes the observation that one third of people with serious symptoms do not go to a doctor (illness iceberg), but that about 11% of people who do not have serious symptoms go to a doctor (trivia) (Hannay (1980), Campbell & Roland (1996)). In other words, those people who most need to go to a doctor are less likely to go. DiMatteo (2004) further shows that the average non-adherence rate to medical advice is 24.8%. Thus, many patients do not follow the advice of their doctor.

[5] The difference between the amount of wealth investors should invest in risky assets according to life-cycle investing approaches (Kintzel (2007)), and what they do (see for example Haliassos (2002), Campbell (2006)) shows that investors invest too little in risky assets. See also the literature review.

investors prefer the graphical description. Furthermore, investors who prefer the verbal risk description put also significantly more effort into studying their preferred description than investors who prefer the graphical description.

The remainder of the paper is organized as follows. Section 2 and 3 contain the literature review and hypotheses. Section 4 describes the data sample, the survey design and the measured variables. Section 5 presents the results: how many participants access the information, how attentive and non-attentive participants differ with respect to their risk tolerance and other variables, which of these variables can explain a participant's risk tolerance, how the experience sampling task affects the investment decisions, and which kinds of participants prefer which kinds of risk description formats. Section 6 concludes.

2 Literature review

A large body of literature shows that many households and retail investors make inefficient investment decisions. One of the most noteworthy observed inefficient investment decisions is that despite the high equity premium many households do not participate in the stock market at all (see e.g. Haliassos (2002), Guiso et al. (2003)). According to financial theory, and as discussed by Kaufmann et al. (2013), households should invest at least some of their wealth into the stock market as soon as they start to save, in order to profit from the equity premium (see e.g. Samuelson (1969), Merton (1969), Arrow (1971)). However, the low stock market participation rates around the world show underinvestment in stocks. In the United States 56% of the population participate in the stock market, in the Netherlands 36%, in Great Britain and Northern Ireland 23%, and in Germany only 6% (DAI (2011)).[6]

According to different life-cycle investing approaches, the average population should invest 60% of their financial wealth into stocks.[7] However as the empirical data show, many households who participate in the stock market invest far less than that. For example, Campbell (2006) shows that the participation rate increases with a household's wealth, but that the fraction of wealth the households invest in stocks remains around 30%-40%. Similar observations are made by Ameriks & Zeldes (2004) who show that the average household holds on average 26.7% of their financial wealth in

[6] Possible reasons for the stockholding puzzle are that households are unaware of stocks (e.g., Guiso & Jappelli (2005)) or they may face one-time entry costs or ongoing participation costs (Campbell (2006)). While ongoing participation costs are an explanation for the nonparticipation among low-wealth households, they cannot explain the observed nonparticipation among the high-wealth households (Haliassos & Bertaut (1995), Vissing-Jorgensen (2003)). Further reasons why households do not invest into stocks are weak investor protection (Giannetti & Koskinen (2010)) or the lack of trust in the country or the stock market (Georgarakos & Pasini (2011), Guiso et al. (2008)).

[7] For example, Kintzel (2007) discusses four different life-cycle investing approaches: the 100-age heuristic, the Malkiel (1990) approach, the shiller plan and the "L fund" plan. Kintzel (2007) shows that across the different age groups the four approaches suggest investing on average 60% of the financial wealth into stocks. Similar results are found by Dolvin et al. (2010), who show that investing 100% into stocks until 10 years prior to retirement or holding so-called target date funds perform best. The average stock holding of the analyzed target date funds are all between 58%-89%, depending on the number of years until retirement.

stocks, and that stockholding is strongly related to wealth. Thus, since the amount of wealth investors invest into stocks is on average too low, in this study an improvement in the investment decision is defined as an increase in the amount of wealth an investor invests into risky assets.

The literature shows that investors make further inefficient investment decisions. For example, Calvet et al. (2007) mention that nonparticipating households would most likely invest inefficiently when they would enter the stock market, e.g. underdiversifying their portfolios. Furthermore, investors often display a home bias (French & Poterba (1991), Lewis (1999)), suffer from the disposition effect (Shefrin & Statman (1985)), or trade too much because they are overconfident (Odean (1999), Barber & Odean (2000)). Different studies show that inefficient investment decisions cause individual welfare costs.[8]

Inefficient investment decisions are especially prevelant in financially illiterate investors (Van Rooij et al. (2011), Guiso & Jappelli (2008), Kimball & Shumway (2010), Klapper et al. (2013), Lusardi & Mitchell (2007), Lusardi & Tufano (2009)). These investors also tend not to use financial advice (Lusardi & Mitchell (2011), Van Rooij et al. (2011), Collins (2012)). There are also socioeconomic factors which influence whether advice is used or not – wealthy and older investors use advice, while poorer and younger investors do not (Hackethal et al. (2012)).

The paper most similar to the current study is Bhattacharya et al. (2012), who provide their participants access to free and unbiased advice. They do not isolate the effect of willingness to become informed, and do not ensure that after reading the financial information no additional future non-monetary costs arise. Furthermore the effort required to access the information could be lower, for example available on click. Lastly, Bhattacharya et al. (2012) do not research additional risk profiler features (for example offering a choice of multiple information formats and experience sampling) and their effect on the participants who are willing or unwilling to become informed.

With regard to how one best communicates financial information, the literature shows that not only the information content is important, but also the format. Given the difficulty and importance of communicating unbiased and theoretically sound advice to the public, several papers review the effectiveness of the different kinds of risk description formats. For example, Weber et al. (2005), Fagerlin et al. (2007), Visschers et al. (2009) recommended not one particular description, but the use of multiple descriptions. Visschers et al. (2009) recommend the combination of numerical (frequencies or percentages) and verbal (qualitative description) probability information. They particularly find that

[8] Based on a dataset of Swedish households, Calvet et al. (2007) estimate the lost return resulting from nonparticipation is between 2.3% and 4.3%. Cocco et al. (2004) show that investors lose 2% of annual consumption by not participating in the stock market. With respect to the inefficient investment decisions, Calvet et al. (2007) observe a median return loss of 1.2% due to underdiversification. Odean (1998) shows that the disposition effect leads to economic costs of 4.4%. Barber & Odean (2000) report that excessively trading (due to overconfidence) costs between 1.5% and 6.5%.

people preferred to receive risk information in a numerical format. Fagerlin et al. (2007) recommend presenting risk numbers using frequencies (e.g. 1 in 100) instead of percentages.

In order to improve the efficiency of an investors' investment decisions, Kaufmann et al. (2013) and Bradbury et al. (2014) study a risk profiling task referred to as experience sampling. They show that experience sampling does improve the investment decisions of investors, namely it leads investors to increase the amount of wealth they invest into risky assets. Thus experience sampling helps investors reduce the inefficiency of their decisions of investing not enough into risky assets.

This paper uses data from the same study as Bachmann et al. (2014), however unlike Bachmann et al. (2014) almost all the data used is so called click stream data. With so-called clickstream data it is analyzed if participants obtain financial information or not, for how long they study the information, which information they study as well as how much effort they put into the different risk profiling tasks. Clickstream data is the term for the electronic record of a person's activity on the Internet (Bucklin & Sismeiro (2009)). It is used in several academic fields of research, such as marketing (Moe (2006), Bucklin & Sismeiro (2009)), computer science (Zhang & Segall (2008), Singh & Singh (2010)), management information systems (Ting et al. (2009)), psychology (Yan & Tourangeau (2008)) and education (Black et al. (2008)). The kinds of data collected include browser activity, as well as clicks and time spent on particular pages. Clickstream data is an additional source of observing behavior, with a wide array of possible applications. Conrad et al. (2006) examine when participants use or do not use additional information (definitions) made available via a click or roll-over, and the impact of that decision on their responses. Yan & Tourangeau (2008) use clickstream data to measure response times to survey questions.

3 Research Hypotheses

If only non-monetary costs (e.g. effort) and the incomprehensibility of the financial information and advice are the reasons why so many investors do not accept and follow financial advice (as in the study of Bhattacharya et al. (2012)), one obvious solution to the problem would be to reduce both to a minimum. The author suggests that a willingness to become informed is a basic requirement before financial advice can be accepted. Therefore one of the main questions in this study is *whether investors are willing to become informed in the first place*, given that non-monetary costs and the incomprehensibility of the financial information are kept to a minimum. If so, a follow up question would be *whether there are differences in the characteristic of investors who are willing to become informed and those who are not, in particular with respect to risk tolerance, financial experience and the effort exerted for risk profiling task.* The current study further questions *whether the investment decisions of investors can be improved after being nudged to do what is good for them*.

The disagreement within the literature suggest that different kinds of investors may prefer different kinds of risk description formats in order to understand the information. This study takes a closer look

at *which kinds of investors prefer which kinds of risk description formats.* The past research about the experience sampling does not answer the question of whether the experience sampling is just as beneficial for investors who are willing to become informed than for those who are not. Therefore, additionally to Kaufmann et al. (2013) and Bradbury et al. (2014) this study analyzes *whether the mandatory experience sampling task has a similar effect on investors, regardless of whether they are willing or unwilling to become informed.*

4 Survey design and data sample

In order to answer the research questions a survey with 378 participants is conducted. In this survey, the participants are financially incentivized to make an informed decision, and are offered information which is (1) very easy to access (clicking on a link), (2) free, (3) causes no further non-monetary costs, (4) unbiased, (5) offered in three different description formats (increasing the comprehensibility). A participant can also choose not to click on the link containing the information, in which case he/she actively decides to ignore the information and to make investment decisions under ambiguity[9].

In order to make sure that the participants understand the information, it is presented in three different risk description formats (graphical, verbal and statistical). The survey design also includes a mandatory risk profiling task, namely experience sampling, which should help them reduce their subjective ambiguity and to make better informed investment decisions. Last but not least, the survey design includes further mandatory risk profiling tasks, in order to analyze how much effort a participant puts into completing such tasks.

4.1 Participants

The survey was conducted online during January 2014. The sample was provided by a professional market research agency and included individuals from a national panel of over 200'000 German residents. Socioeconomic questions were used to apply a quota sampling procedure for selecting participants from the general population to ensure a broad sample.

In total 1137 participants started the survey, and 439 of them completed it. 654 participants quit before completing the survey, and 44 were screened out. Data filters are applied to ensure that participants who were inactive for an extended period are excluded from the dataset, to avoid skewing the results. For this purpose, three maximum time filters were defined: total time spent at 60 minutes, retention time on an individual page at 15 minutes, and studying the risk description on a given page at 4 minutes. After applying the filters to the 439 participants who completed the survey, 374 remained, representing a response rate of 32.9%.

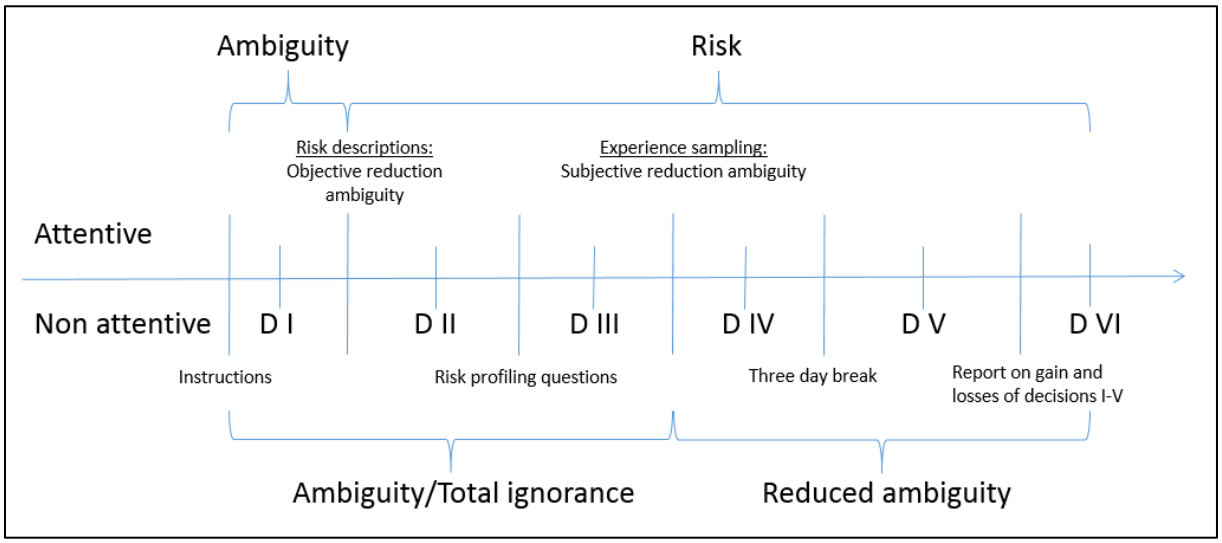
[9] The decision under ambiguity could also be called a decision under total ignorance. Participants actively decide to ignore the information about the risky asset for their investment decision.

All decisions and questions relevant for the final payment were clearly mentioned in the introduction and marked with a red side bar. After the study the participants received a base payment (13.25 Euro), plus a randomly drawn payment for one of the six outcomes of the investment decisions they made during the survey. The total payment varied between 21.75 and 27.65 Euros, and was on average 26.20 Euros. Given the average completion time of 20 minutes this is equivalent to a monthly net income of 11'200 Euro, which is as much as or greater than all relevant real monthly net income classes of the participants. Therefore it can be assumed that the incentive to complete the study was for all participants sufficiently high. Note that since the survey design included a three day break, a high incentive was also important in order to increase the chances that the participants rejoin after the break.

4.2 Design

Figure 1 illustrates the survey design. The survey is based on six stages. At each stage, the participants have to make an investment decision. Between the stages participants gain access to new information about the investment's return distribution or they have to complete certain risk profiling tasks. In the following, those stages are described in detail.

Figure 1: Survey design



Before the participants can start with the first stage, they have to carefully read the instructions. The instructions inform the participants about the content of the survey, the tasks they have to complete, the definitions used in the survey (e.g. what is a return), the monetary incentives, and how long the survey will take. The instructions explain in detail that at each stage an investment decision (D I to D VI) has to be made and that each decision is incentivized. With two control questions it is tested if the participants read and understood the instructions. Only if they correctly answer the two control questions, can they continue with the survey.

For the six investment decisions the participants are endowed with a certain amount of wealth. In order to eliminate risk-taking behavior motivated by investment based changes in wealth between the stages, participants start each stage with the same amount of wealth. The participants can invest their endowment into a risk-free and a risky asset. The risk-free asset gives a guaranteed return of 2%. The returns of the risky asset are drawn from a normal distribution with a mean of 7% and a standard deviation of 16%. The values for the return distribution are derived from the SPX Index between 1962 and 2012. For the final payment one of the six outcomes of the investment decision on a 10 Euro endowment is randomly drawn.

At stage one the participants have to make their first investment decision (D I). In the instructions the participants were informed about the return distribution of the risk-free asset but not about the one of the risky asset. Therefore, all participants have to make their first investment decision under ambiguity. The first decision is used to measure the tolerance for ambiguity and it serves as a benchmark for the subsequent decisions.

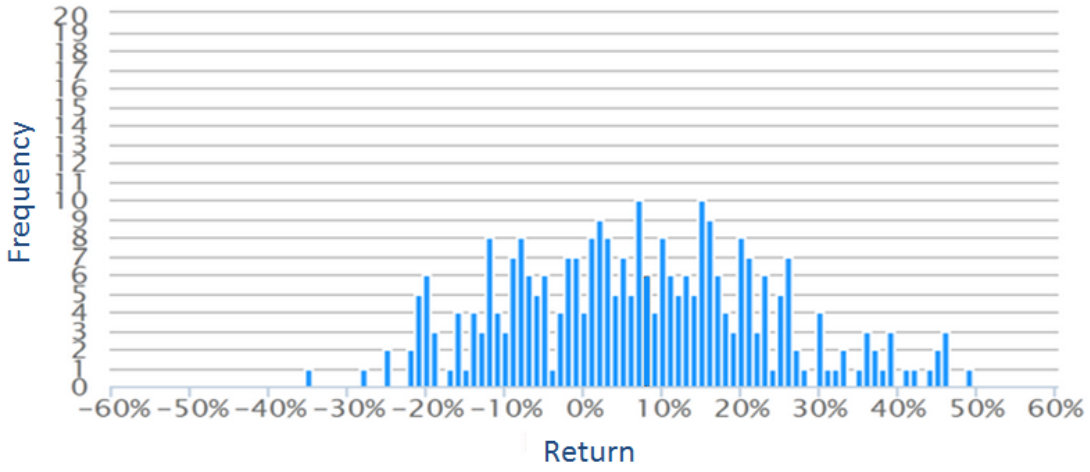
At stage two complete information about the return distribution of the risky asset is made accessible to the participants. The participants are clearly informed that they simply have to click on a link to access the information. In order to make sure that the participants understand the information, the information

is accessible in three different risk description formats (see Figure 2): A *graphical distribution* represented by a histogram of 280 randomly drawn returns, *scenarios described verbally* which give an impression of how many draws out of 100 the returns lie in a certain range, and a *statistical description* where the returns are described as normally distributed and the standard deviation of the distribution is given. The participants are free to study the format they most prefer and with which they are most familiar. The participants are also clearly informed that for the rest of the study they can access the risk descriptions through a help button. After the participants have had the opportunity to study the information they make their second investment decision (D II).

Figure 2: Risk descriptions

Graphical description

In the following graphic you see the realized returns and their frequencies out of 280 randomly drawn scenarios for the risky asset. The higher a bar is, the more frequently that return was drawn.



Verbal description

The average return for the risky asset over all possible scenarios is +7% per annum. In 70 out of 100 scenarios one can expect that the return falls between -10% and +24% per annum, and in 30 out of 100 scenarios the return is lower than -10% and higher than +24% per annum.

The positive or negative deviation from the average return is the same, and has the same probability. For example, a return of -3% has the same probability as a return of +17%.

Statistical description

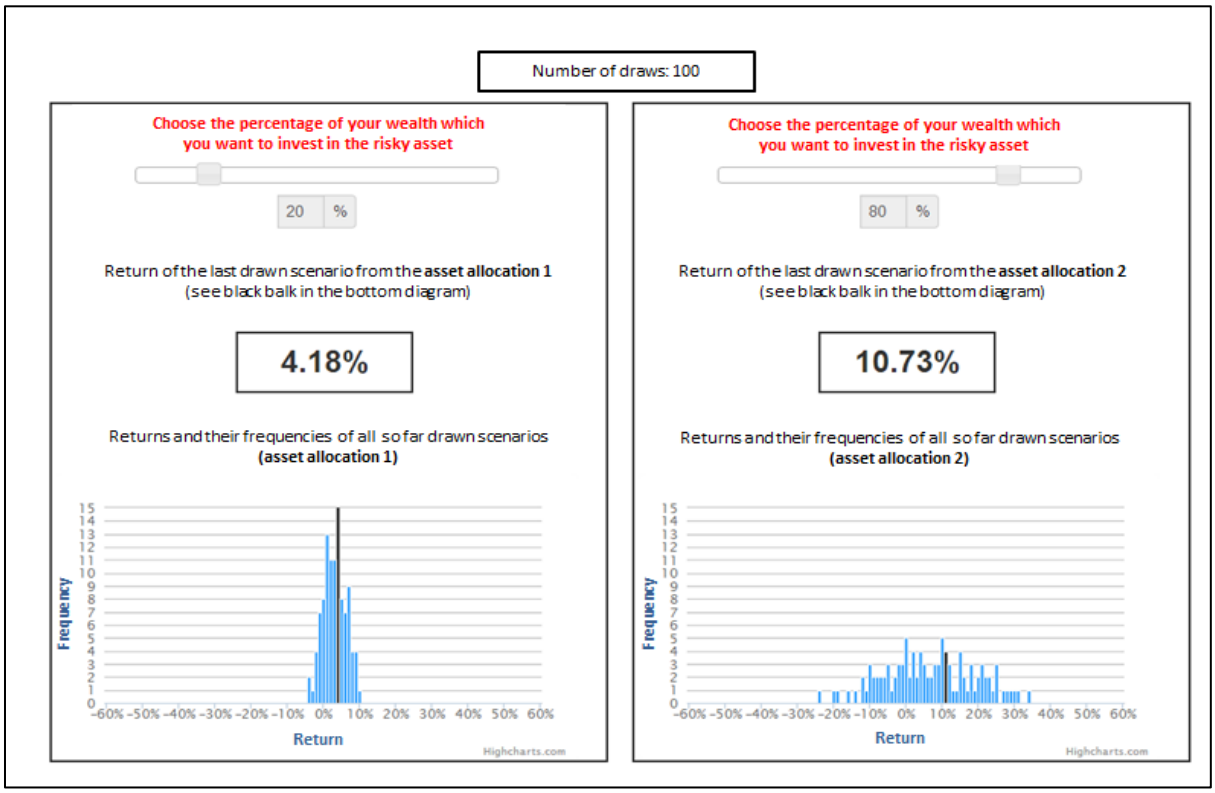
The returns are normally distributed with a mean of +7% and a standard deviation of 16%. The normal distribution has the property that returns close to +7% are more probable than those further away, and that the probability of a return of -3% has the same probability as a return of +17%.

Between the stages two and three no new information is provided to the participants. Instead, participants have to answer risk profiling questions. In particular, they are asked about their financial risk preference and their financial experience. After they have answered the questions, they can continue to stage three where they make their third investment decision (D III).

Between the stages three and four participants have to complete a mandatory experience sampling task. The experience sampling task is based on the idea of Kaufmann et al. (2013) where participants have to draw return scenarios from different asset allocations. The task should help the participants reduce their subjective ambiguity and to make better informed investment decisions. In contrast to the risk descriptions, the experience sampling task does not fully disclose the parameters of the return distributions.

The following further points are considered in the experience sampling tool used in this study (see Figure 3): Firstly, in order to improve the comparability between different asset allocations, the experience sampling tool allows participants to simultaneously view the outcomes for two different asset allocations side-by-side. Secondly, the value of the most recently drawn return can easily be seen and compared (number in the box and black bar in the histogram). Thirdly, the drawn returns are presented in a histogram. This allows the participants to experience how the distribution of the asset allocations arise and how they differ. Fourthly, one or both asset allocations can be changed at any time. When an asset allocation is changed both histograms are reset for a new clear comparison. Fifthly, the randomly drawn returns for the risky asset are always the same for both asset allocations, and so the difference in returns comes only from the asset allocation between the two assets. Sixthly, the y-axis changes simultaneously (it must change to accommodate more samples as they are drawn) for both histograms, to avoid any framing effects. Fifthly, the participants have to draw at least 200 scenarios. The minimum number of draws should ensure that the participants get a sufficient impression of the asset allocations' return distribution. After the participants have drawn at least 200 scenarios they can proceed to stage four where they make the next investment decision (D IV).

Figure 3: Experience sampling tool



Between the stages four and five the participants have to make a three day break. Taking a break is similar to industry as after having received the information, investors often first take a few days before making an investment decision. Participants are given the option to download the risk description of the risky asset, like in practice advisors give factsheets to clients. After the three day break, the participants make their fifth investment decision (D V).

Between stages five and six, the participants receive a report on the gains and losses associated with each of their five investment decisions. For each decision they are reminded of the allocations taken, the return, and the payment units (ECU) the decision results in. After the participants have seen the outcome of their previous five investment decisions, they make their last investment decision (D VI).

4.3 Measured variables

Attention to risk description: To view a risk description participants need to click on a link. The risk description is then shown in a pop-up window, blocking the view on the main window. The pop-up windows allow tracking which risk description is viewed at which point in the survey, and for how long.

Financial experience: The financial experience is measured with five questions. The participants are asked about their consumption of financial news, their subjective estimation of their financial as well as statistical knowledge, and their trading experience and trading frequency. Each of the five questions have 7 answer possibilities which are ordinally ranked (see Appendix), the higher the number, the

more experienced the participant. In order to increase the reliability, the average score of the five answers is taken as the degree of a participant's financial experience.

Attention to experience sampling: In the case of the experience sampling tool, the following three variables are measured: (1) the time spent using the experience sampling tool; (2) the number of drawn scenarios and (3) the number of tested asset allocations.

Attention to remaining risk profiling tasks: These tasks include everything except the time spent to complete the experience sampling task and to study the risk descriptions. Therefore, the attention given to the remaining risk profiling tasks is calculated by subtracting the attention to the risk descriptions and to the experience sampling from the total time the participants had to complete the survey.

Attention to investment decisions: Measured by the average time a participant spent to think about the six investment decisions before making them.

Effort: The effort a participant exerts for the survey is measured by the total time they have to complete the survey. In other words it is the sum of the attention given to the risk descriptions, to the experience sampling tool and to the remaining risk profiling tasks.

Risk tolerance: Measured by the percentage of the endowment invested into the risky asset. For example, the risk tolerance of participant A who invests 65% of the endowment into the risky asset is higher than for participant B who invests only 30%.

Confidence with the investment decisions: For each of the six investment decisions the participants are asked how confident they feel with their decision. The answer is given on a Likert-scale from 1 to 7. The higher the number, the more confident they feel that they made the right decision.

Attentive vs. non-attentive participants: Attentive participants are defined as those who study at least one of the three risk descriptions in stage two. As Figure 1 shows, attentive participants make the investment decisions II-VI under risk, while non-attentive participants make all six decisions under ambiguity (although the ambiguity for the decisions IV-VI is reduced after the experience sampling task).

Preferred risk description: The attention given to the risk descriptions is also used to identify which risk description the attentive participants most prefer. The level of preference is measured by the total amount of time a participant spent to study a given risk description. In order to improve the time as a

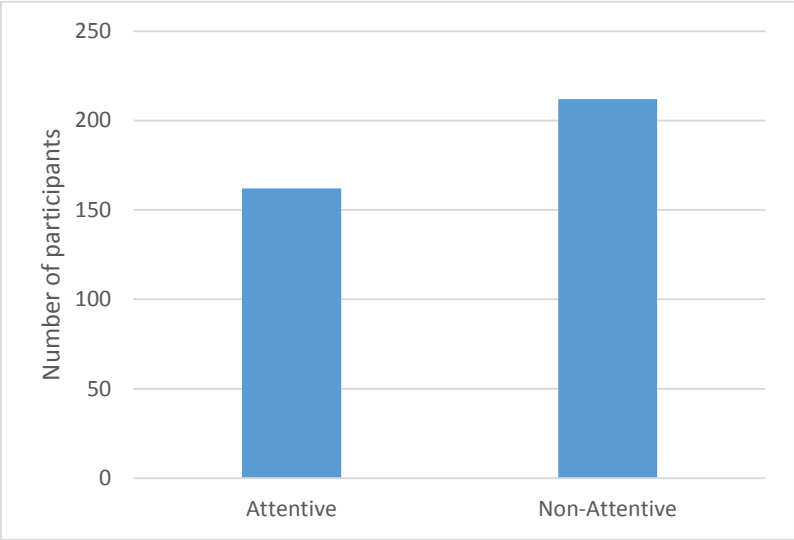
proxy for the preference, the amount of time a participant spent to study a risk description for the first time was not considered.[10]

5 Results

5.1 Attention to the risk descriptions

Figure 4 shows the number of participants who gave some attention to the risk descriptions. 162 participants studied the complete information about the risky asset's return distribution. With the complete information the participants could objectively reduce their ambiguity for the subsequent decisions. They spent on average 23 seconds to read them (see Panel B in Table 1). On the other hand, 212 participants were not interested in reducing their ambiguity. These participants consciously decided to make all of their decisions without knowing the exact details of the risky asset. Considering that the decisions were highly incentivized, this is a surprising finding. The possible explanation that these participants were generally not interested in the survey can be precluded, since at this point in time they exactly knew what they needed to do. In the case they would have not been interested, they would have already left the survey. The finding rather indicates that many investors are intrinsically insufficiently motivated to consume information, even though it has value for their investment decisions and payment. Therefore, it cannot be assumed that just handing out information about an investment to investors (e.g. a key information investor document (KIID)) is enough. Instead, such information documents could be handed out in conjunction with an explanation from an advisor.

Figure 4: Number of attentive and non-attentive participants

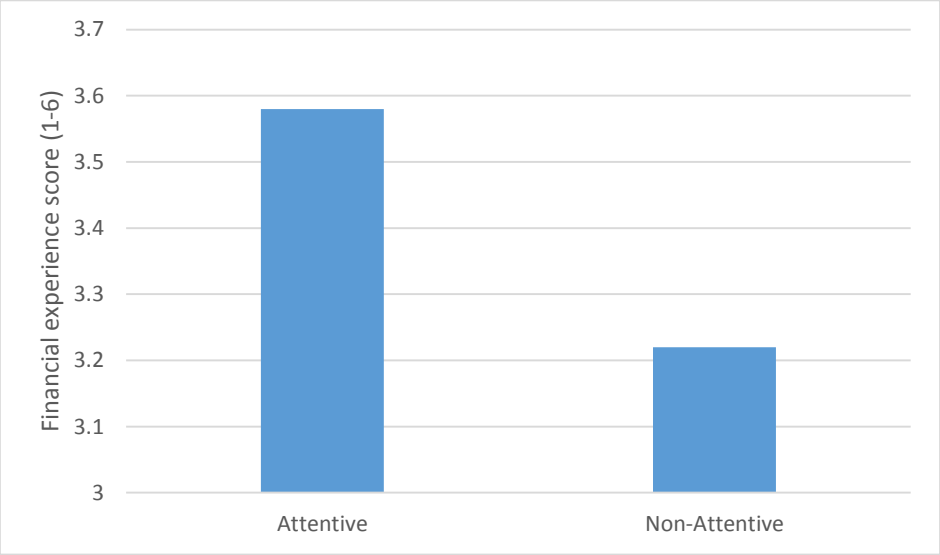


In order to better identify such non-attentive investors, in the following the characteristics of non-attentive participants are compared with the attentive participants.

[10] Another reason why a participant may study a particular risk description longer is because he or she does not understand the description very well, and not because the participant prefer it. While this is especially a problem when the participants study the risk descriptions for the first time, the problem dissipates over the subsequent study sessions.

Figure 5 shows the most important difference between the two groups, the financial experience. The attentive participants reached on average a financial experience score of 3.58 (out of 7) while the non-attentive participants only reached an average score of 3.22. The 11% difference is highly statistically significant (p-value < 0.01). Therefore attentive investors tend to have more working experience in the financial sector, consume more financial news and have more trading experience. It seems that investors who know a lot about investments better recognize that they need objective information to reduce their ambiguity and to make better investment decisions.

Figure 5: Average financial experience of the attentive and non-attentive participants



Panel C of Table 1 also shows that attentive participants have a significantly higher level of education as well as income and wealth (p-value < 0.05). No significant differences could be found regarding age, gender, number of children and job position (see Panel C in Table 1).

5.2 Behavioral differences between the attentive and non-attentive participants

So far the comparisons between the attentive and non-attentive participants have shown that there are significant differences with regard to certain characteristics. In a next step it is further tested if the two groups also differ in their behavior. One of the central variables for the analysis is the risk tolerance. As mentioned in the previous section the risk tolerance is measured by the percentage of the endowment a participant invests into the risky asset, i.e. the more invested in the risky asset, the higher the risk tolerance.

5.2.1 Switching from ambiguity to risk

The starting point is the first decision. At the point in time of the first decision, the attentive as well as the non-attentive participants do not know the return distribution of the risky asset. Therefore, the first investment decision is made under ambiguity and serves as a first unbiased comparison. As Panel F of

Table 1 shows, although the attentive participants have no more objective information about the risky asset, they take much more risk than the non-attentive participants. The attentive participants invest on average 35.27% of their endowment into the risky asset. The non-attentive participants are much more conservative and invest only 22.19% therein. In other words, with a difference of 13.08 percentage points, the attentive participants have a 58% higher risk tolerance. The difference is highly significant on the 1% significance level. Panel G of Table 1 further shows that both groups feel a similar degree of confidence with their first decision. Attentive participants reach a confidence score of 4.96 (out of 7) while the non-attentive participants have on average a score of 5.02. This first comparison shows that attentive participants have in general a higher risk tolerance (e.g. because they have a higher tolerance to ambiguity or are less risk averse (Ghosh & Ray (1997)). This finding is of great interest to advisors. Different studies have shown that a large portion of the population does not save enough to be adequately prepared for their retirement (Bernheim & Scholz (1993), Thaler & Benartzi (2004)). One important way to increase the savings is to participate at the stock market. Kaufmann et al. (2013) describes that standard models of lifetime consumption suggest investing at least some of their wealth in stocks in the early life stages (e.g., Samuelson (1969), Merton (1969), Arrow (1971)). Non-attentive investors face a higher probability of not having accumulated sufficient capital for retirement as a result of not taking enough risk, i.e. of having an inadequate risk tolerance.

After the first decision, the attentive participants study the risk descriptions. Therefore the attentive participants switched from a decision under ambiguity to a decision under risk. In order to analyze the effect of this change, the risk tolerance of the first investment decision is compared with the one in the second investment decision. Of course, the non-attentive participants were not considered for this analysis, as they did not click on the risk descriptions. As Panel A of Table 2 shows, the risk tolerance slightly increases from 35.27% to 36.36% after the attentive participants have studied the risk descriptions. Switching from the decision under ambiguity to a decision under risk increases the risk tolerance by 1.09 percentage points. The difference is moderately significant on the 10% significance level.

Knight (1939) and Ellsberg (1961) argue that people differentiate between risk (where probabilities are known) and ambiguity (where probabilities are unknown) and may display ambiguity aversion in the same way as they display risk aversion (see also Bossaerts et al. (2010)). Similarly, the finding in this study suggests that attentive investors have a similar aversion to both ambiguity and risk. It seems as though they have a certain level of risk tolerance in mind, perhaps based on former investment experiences, which they consistently apply. In Panel B of Table 2 it can further more be seen that studying risk descriptions also leads the attentive participants to feel more confident with their investment decisions. The confidence increases from 4.96 to 5.07 (out of 7). The increase is also moderately significant on the 10% significance level. This finding indicates that decisions under risk lead to a slightly higher confidence than decisions under ambiguity.

The attentive participants made the decisions II-VI under risk, while the non-attentive participants made the decisions under ambiguity. Panel F of Table 1 shows that attentive participants invest on average 37.41% of their endowment into the risky asset while non-attentive participants only invest 23.78%. In other words, given the difference of 13.63 percentage points, the attentive participants have a 57% higher risk tolerance. The difference is highly significant on the 1% significance level. No significant differences could be found for the confidence (see Panel G in Table 1). The attentive participants gave an average confidence score of 5.1 compared to 4.99 given by the non-attentive participants.

Combining the above findings it can be concluded that attentive participants have in general a higher tolerance for ambiguity and risk, that they do not differentiate much between ambiguity and risk and that therefore the difference in the risk tolerance between the attentive and non-attentive participants remains stable after the attentive participants have studied the risk descriptions. Possible explanations for the observed behavior are heuristics people rely on when making decisions. Two well-known and important heuristics for decision making are the representativeness and anchor heuristics (see Tversky & Kahneman (1974)). Jordan & Kaas (2002) find that investors display an expected return anchoring, and that the representativeness heuristic affects their perceived investment risk. For the present study this could imply the following: For decision I participants may rely on the representativeness heuristic. Since they do not know the return distribution of the risky asset, they may use a stereotype to determine the risky asset's risk. In this case most likely a stock. For the decision II-VI it seems that the participants heavily rely on the anchor heuristic. The first investment decision serves as an anchor for the subsequent decisions (e.g. with respect to the expected return). Participants adapt their behavior only very slowly and marginally to the new information. The finding that attentive participants have a higher tolerance for ambiguity than non-attentive participants is also confirmed by Jordan & Kaas (2002). They find that informed participants experienced lower ambiguity in their decisions than uninformed participants.[11] Furthermore they conclude that the use of heuristics can be observed in both groups, which is also similar to the findings in this paper. Of course, also other heuristics like availability and recognition (see Tversky & Kahneman (1973), Goldstein & Gigerenzer (1999), Goldstein & Gigerenzer (2002)) are used by investors to make their investment decisions. The implication for industry is that client advisors should individually assess what heuristics his/her client applies. Since heuristics can cause cognitive biases, the advisor should also check if the client is affected by any such biases as well.

[11] The classification into informed and uninformed is based on the subjective self-assessment of the participants' knowledge and experience with investments.

Table 1: Differences between attentive and non-attentive participants

	Attentive participants	Non-attentive participants	p-value (Mann-Whitney test)
A. Number of respondents			
	162	212	
B. Attention to risk description (effort)			
Time spent (in seconds)	0.23		
C. Financial experience and socioeconomic characteristics			
Financial experience (1=very low; 7=very high)	3.4	3.1	0.0027
Male	83	90	
Age	39.98	40.4	0.5963
Number of children	0.58	0.67	0.8186
Level of education (1=No education; 7=PhD)	4.58	3.86	0.0000
Job position (1=Apprentice; 7=Employee in top management)	3.25	3.39	0.8012
Level of income (1=0-1'300; 7=>18'000)	2.73	2.47	0.0340
Level of wealth (1=0-500; 7=>175'000)	3.61	3	0.0010
D. Attention to risk profiling tasks (effort)			
Time spent for experience sampling task (in seconds)	4.20	3.36	0.0000
Number of scenarios tested	264	246	0.0128
Number of different asset allocations tested	5	4	0.0089
Time spent for remaining risk profiling tasks (in seconds)	19.44	15.04	0.0000
E. Attention to investment decision (effort)			
Time spent (in seconds)	0.34	0.21	0.0000
F. Risk tolerance			
Decision I	35.27%	22.19%	0.0000
Ø Decision II-VI	37.41%	23.78%	0.0000
G. Confidence with investment decision(s)			
Decision I	4.96	5.02	0.7697
Ø Decision II-VI	5.1	4.99	0.4605

Table 2: Effect of risk descriptions on ambiguity

	Before studying the risk descriptions (decision I)	After studying the risk descriptions (decision II)	p-value (Mann-Whitney test)
Attentive			
A. Risk tolerance			
% of risky asset hold in the portfolio	35.27	36.36	0.1018
B. Confidence			
Index (1=very low; 7=very high)	4.96	5.07	0.0800

Table 3: Effect of experience sampling on subjective ambiguity (attentive vs. non-attentive)

	Before experiene sampling (decision III)	After experiene sampling (decision IV)	Decision VI	p-value (Mann-Whitney test) Before vs. After
Attentive				
A. Risk tolerance				
% of risky asset hold in the portfolio	36.13	41.2	36.91	0.0000
B. Confidence				
Index (1=very low; 7=very high)	4.88	5.03	5.32	0.0694
Non attentive				
C. Risk tolerance				
% of risky asset hold in the portfolio	22.21	24.8	25.13	0.0001
D. Confidence				
Index (1=very low; 7=very high)	5	4.8	5.13	0.0119

5.2.2 Reducing subjective ambiguity with experience sampling

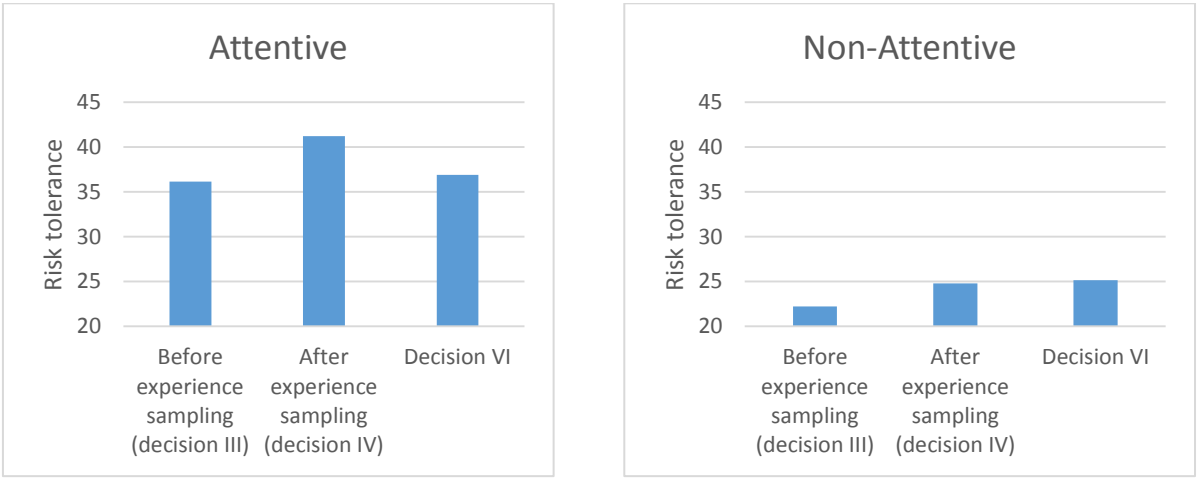
Between the third and fourth investment decision the attentive as well as the non-attentive participants had to complete an experience sampling task. Participants must draw at least 200 return scenarios of a self-defined asset allocation (e.g. 20% risky asset). They were also required to compare at least two different asset allocations. The task helps reduce the subjective ambiguity regarding the return distribution of different asset allocations. However, in contrast to the risk descriptions the experience sampling task does not make unknown distribution parameters known. The attentive participants already know the parameters from the risk descriptions, although experience sampling may further reduce their subjective ambiguity (e.g. to get a better feeling for the known return distribution). In contrast, the non-attentive participants make the following investment decisions IV-VI still under ambiguity although the ambiguity is reduced.

During the survey the experience sampling task was the only moment when the non-attentive participants were obliged to deal with the characteristics of the risky asset. Comparing the difference between the decisions III to IV and decisions IV to VI is used to analyze how the risky asset return distribution information influences the risk tolerance of non-attentive participants, and if the change in risk tolerance is stable. Figure 6 shows the decisions III, IV and VI.[12] As can be seen, under ambiguity non-attentive participants invest 22.21% of their endowment into the risky asset (decision III). After they were obliged to complete the experience sampling task, they invested on average 24.8% into the risky asset (decision IV). The difference of 2.59 percentage points is highly significant (p-value < 0.01) and corresponds to an increase of 11% in risk tolerance. Regarding the stability of the change, decision IV shows that the higher risk tolerance remains highly stable. For their final decision VI, non-attentive participants invested on average 25.13% of their endowment into the risky asset. The slightly higher risk tolerance (0.33 percentage points) is not significantly different to decision IV. A surprising finding is that non-attentive participants felt less confident after completing the experience sampling task (see Panel B in Table 3). The confidence went slightly down from 5.0 to 4.8 (p-value < 0.05). Although the experience sampling tool was exactly described, the decrease in confidence indicates that non-attentive participants have difficulties to interpret the information from the experience sampling. One possible reason could be that non-attentive participants are not comfortable with interpreting return distributions.[13] Client advisors should therefore not only explain the tool to the investors, but also help them to interpret the presented information.

[12] For the exact numbers see panel A in Table 3

[13] The limited financial experience of the non-attentive participants strongly supports this assumption.

Figure 6: Effect of experience sampling on subjective ambiguity (attentive vs. non-attentive)



In the case of the attentive participants, the experience sampling task had also a big influence on the risk tolerance. As Figure 6 shows, attentive participants invested 36.13% into the risky asset before they reduced their subjective ambiguity (decision III).[14] After the reduction, they increased the percentage of risky asset to 41.2% (decision IV). The difference of 5.07 percentage points is highly significant (p-value < 0.01) and corresponds to a 14% increase in risk tolerance. However, in contrast to the non-attentive participants, the change in risk tolerance is not stable. The percentage of the endowment invested into the risky asset goes down to 36.91% for the last decision VI, which corresponds more to the risk tolerance displayed in decision III (36.13%) than in decision IV (41.2%). The attentive participants felt more confident after completing the experience sampling task (see Panel D in Table 3). The confidence went significantly up from 4.88 to 5.03 (p-value < 0.01).

In summary, the experience sampling task differently influences the risk tolerance of attentive and non-attentive participants. In both cases, the task significantly increases the risk tolerance. While the increase is higher for the attentive participants (14% vs. 11%), the increase is much more stable for the non-attentive participants. The findings indicate that it might be especially useful to convince non-attentive investors to reduce their ambiguity. The achieved significant and stable increase in risk tolerance may help these investors take adequate risk in the retirement plans. Differences can also be observed regarding the confidence with the investment decision. Attentive participants feel more confident after they have reduced their subjective ambiguity while non-attentive participants feel less confident after they have reduced their ambiguity.

5.2.3 Differences between the first and final investment decisions

In order to analyze if the behavior between the two groups has relatively changed, the relative differences between decisions I and VI are compared.

[14] For the exact numbers see panel C in Table 3.

As Panel A and C in Table 4 shows, in decision I the attentive participants invest 35.27% of their endowment into the risky asset, while non-attentive participants invest only 22.19%. For decision VI, both groups significantly increase their risk tolerance to an allocation of 36.91% (p-value < 0.1) and 25.13% (p-value < 0.01) in the risky asset respectively. The relative comparison between decisions I and VI shows that the difference in risk tolerance between the two groups moderately declined from 13.08 to 11.78 percentage points. The decline in the difference indicates that the mandatory risk profiling tasks are relatively seen more effective for non-attentive participants. In other words, requiring non-attentive investors to inform themselves can benefit them. Regarding the confidence with the decisions, Panels B and D in Table 4 show that for decision I the attentive participants had an average confidence score of 4.96. The non-attentive participants had a slightly higher score of 5.02. For decision VI both groups felt more confident with their decisions. The attentive participants had on average a confidence score of 5.32 (p-value < 0.01) while the non-attentive participants had a score of 5.13 (not significantly higher). The relative comparison between the two groups shows that the difference in confidence increased between decisions I and VI. For decision I, non-attentive participants had a higher confidence score with a margin of 0.06. For decision VI, attentive participants had a higher confidence score with a margin of 0.19. This finding indicates that switching from ambiguity to risk (as for the attentive participants) leads to a higher increase in confidence than just reducing the ambiguity (as for the non-attentive participants).

The most important changes in risk tolerance for the attentive and non-attentive participants can be summarized as follows. In the case of the attentive participants, the most stable change in risk tolerance occurred after the participants studied the risk descriptions (e.g. switching from ambiguity to risk). The biggest change in risk tolerance occurred after the experience sampling task (reducing subjective ambiguity). However, this change was not stable and disappeared until the final decision. In the case of the non-attentive participants, the largest and most stable change in risk tolerance occurred after the participants completed the experience sampling task (reducing ambiguity). The relative difference in risk tolerance between the two groups decreased over time, indicating that forcing non-attentive investors to complete risk profiling task is especially beneficial for them.

Table 4: Effect of risk profiling on the risk tolerance and confidence

	Decision I	Decision VI	p-value (Mann-Whitney test)
Attentive			
A. Risk tolerance			
% of risky asset hold in the portfolio	35.27	36.91	0.0576
B. Confidence			
Index (1=very low; 7=very high)	4.96	5.32	0.0037
Non attentive			
C. Risk tolerance	22.19	25.13	0.0006
% of risky asset hold in the portfolio			
D. Confidence			
Index (1=very low; 7=very high)	5.02	5.13	0.1555

5.2.4 Effort exerted

How much effort the attentive and non-attentive participants exert to complete the different risk profiling tasks and to think about their investment decisions is summarized herein. The effort is measured by the time they spent on the tasks.

Panels D and E of Table 1 show the average time the participants spent to complete the experience sampling task, the remaining risk profiling tasks (e.g. answering questions about their risk preference) and to think about the investment decision before making it. Attentive participants spent on average 4 minutes and 20 seconds to better understand the return distribution of different asset allocations, and thus subjectively reduce the ambiguity. On average they sample 264 scenarios and test 5 different asset allocations. In contrast, non-attentive participants spent much less time on the experience sampling task. On average, they spent only 3 minutes and 36 seconds (25% less time) to better understand the return distribution of different asset allocations, sample 246 scenarios and test 4 different asset allocations. The differences in effort exerted by the two groups are highly significant on the 1% significance level. A similar pattern can be observed for the remaining risk profiling tasks. The attentive participants spent 19 minutes and 44 seconds to complete the remaining tasks while the non-attentive participants spent only 15 minutes and 4 seconds. The relative difference of 29% is highly significant (p-value < 0.01). The largest difference can be observed for the time spent to think about the investment decisions. Attentive participants take on average 34 seconds to think about their investment decisions. Non-attentive participants take only 21 seconds, which is 62% less time. The difference is highly significant on the 1% significance level. Taking time to make a decision and to improve one's understanding of the investment, is a sign that the decision maker thought hard about his/her decision and his/her preferences. The significant differences between the two groups indicate that investors who do not pay attention to important information and spend less time for risk profiling tasks have a higher chance that their portfolio allocation does not correspond to their risk tolerance. As a result their portfolio allocations must be adjusted in the future. This assumption is confirmed by the data. Participants who have spent time reading the risk descriptions do not significantly change their final asset allocation (decision VI) after they have seen the return realization of their prior investment decisions (decision I to V). However, participants who did not pay attention to the risk descriptions significantly increase (p-value < 0.01) the amount of the risky asset in their portfolio from 23.21% to 25% after they have seen the return realizations (median values show an even larger difference, from 20% to 24.5%). The differences show that non-attentive participants put generally much less effort into risk profiling tasks and thinking about the investment decision. This finding presents a significant challenge for advisors. They must somehow convince the less motivated investors to improve their understanding and to think harder about their decisions and preferences. In other words, less motivated investors benefit from being nudged to do what is good for them.

5.3 Explaining risk tolerance with attentiveness, financial experience, and effort

The descriptive analysis has so far shown that the attentive participants have more financial experience, exert more effort and have a higher risk tolerance than the non-attentive participants. The following analyzes whether the attention given to the risk description, the financial experience, as well as the effort can explain the risk tolerance.

For the analysis, a multiple linear regression is made. As the dependent variable the average risk tolerance of the decisions II-VI is taken (decisions made after the attentive participants have studied the risk descriptions). The independent variables are a dummy variable for the attention given to the risk description, the financial experience (continuous variable), and the effort measured as total time spent to complete the survey.[15]

$$\emptyset\, risk\ tolerance\ = \alpha + \beta_1 dummyAttentiveness + \beta_2 financial\ experience + \beta_3 effort + e$$

The results in Panel A of Table 5 show that the intercept is highly significant (p-value < 0.01) and has a value of 10.19%. The attentiveness is also highly significant (p-value < 0.01) and positive. Attentive participants invest on average 11.07 percentage points more of their endowment into the risky asset. Furthermore, a one point increase in the financial experience leads to a 2.86 percentage point increase in the risk tolerance. Therefore, the relationship between the risk tolerance and the financial experience is highly significant (p-value < 0.01) and positive. Last but not least, spending time doing the risk profiling task is positively related to the risk tolerance (p-value < 0.05). A one unit increase in the effort leads to a 0.23 percentage point increase in the risk tolerance. The adjusted R-squared is 14.4%. In order to test the stability of the results, control variables are added to the regression, including age, gender, number of children, education, job position, income and wealth. The regression with the control variables shows that all the independent variables are highly stable, and the adjusted R-squared slightly increases to 18.03%. Together with the results from the descriptive analysis it can be said that the attentive participants generally have a higher risk tolerance than non-attentive participants. The greater financial experience and effort exerted by the attentive group additionally increases their risk tolerance, thus increasing the difference in risk tolerance when compared to the non-attentive group. Furthermore the findings clearly show that non-attentive participants are more impatient than the attentive participants. They spend no time to study the risk description, and minimize the time to complete the risk profiling tasks and to think about the investment decisions. Together with the observation that non-attentive participants have a low risk tolerance, the finding of Anderhub et al. (2001) can be confirmed, namely that risk averse individuals are more impatient.

[15] Note that also the interaction terms between the dummy variable and the independent variables financial experience and effort, were analyzed. The presented model best fit the data.

Table 5: Risk tolerance explained by attention, description format, financial experience and effort

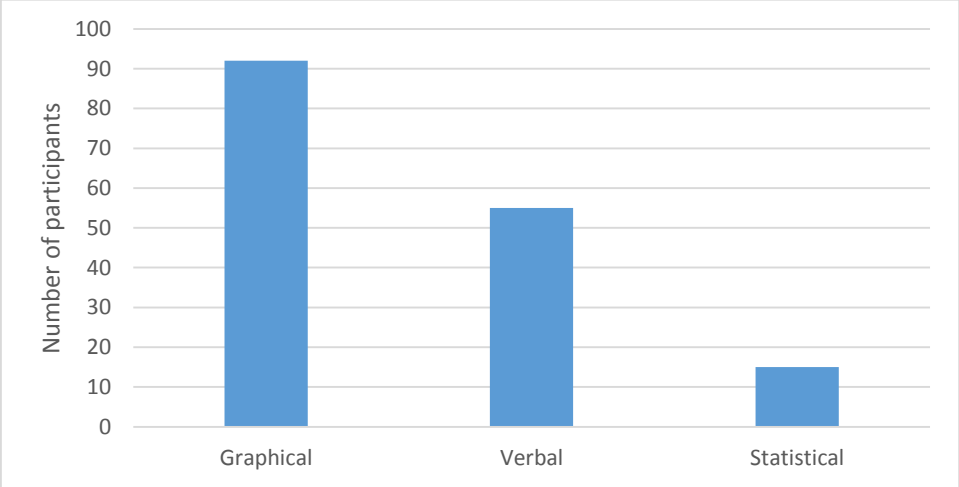
	Estimate (Std. Error)	Estimate (Std. Error)	Adjusted R^2	Adjusted R^2
A. Attention Yes/No				
Intercept	10.1998**	-18.7472		
	(3.4751)	(21.3228)		
Attentive	11.0747***	9.1492***		
	(2.1239)	(2.3065)		
Financial experience	2.8565***	2.4988**		
	(0.7683)	(0.9448)		
Effort (total time)	0.228*	0.346**		
	(0.1062)	(0.1146)	0.1440	0.1803
B. Attention Format (graphical vs. verbal)				
Intercept	20.619825**	32.07802		
	(7.095412)	(32.63727)		
Format verbal	7.667898*	5.11654		
	(3.529934)	(3.70654)		
Financial experience	4.145065**	4.88805**		
	(1.46788)	(1.76202)		
Effort (total time)	-0.000401	0.01216		
	(0.170346)	(0.20252)	0.0815	0.1663
Control variables (age, gender, children, education, job position, income, wealth)	No	Yes	No	Yes

5.4 Preferred risk description formats of the attentive participants: graphical, verbal or statistical

The following analysis focuses only on the 162 participants who gave some attention to the risk descriptions. For the analysis the participants are divided into three groups: graphical, verbal and statistical. The participants are assigned to the risk description they most prefer. The level of preference is measured by the total amount of time a participant spent for studying the risk description. In order to improve the time as a proxy for the preference, the amount of time a participant spent to study a risk description for the first time is not considered.

Figure 7 shows the number of participants who prefer the graphical, verbal or statistical risk description. Of the 162 attentive participants, 92 prefer the graphical description, 55 the verbal description and only 15 prefer the statistical description. Since 15 observations are not enough for most statistical tests, the statistical description is excluded for further analysis.

Figure 7: Number of participants who prefer the graphical, verbal or statistical risk description

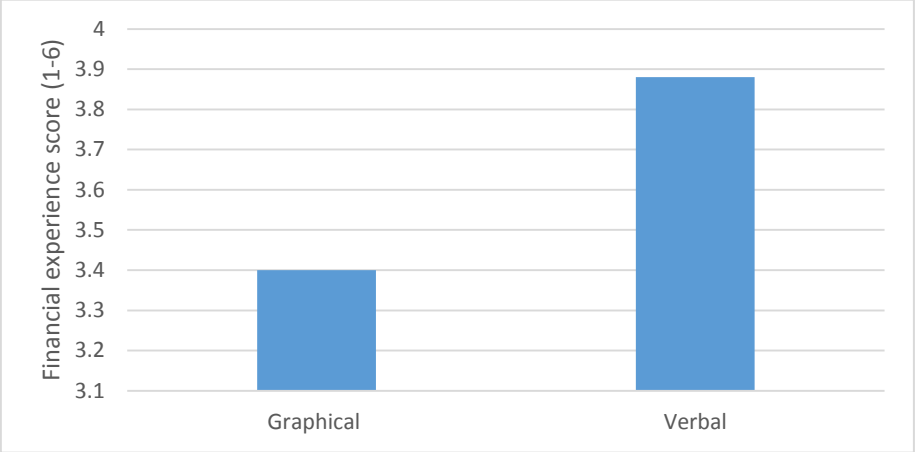


5.4.1 Financial experience and socioeconomic characteristics of the graphical and verbal groups

Figure 8 shows the difference in financial experience between the graphical and verbal groups. Similar to the comparison between the attentive and non-attentive participants, a significant difference between the graphical and verbal groups can be observed (p-value < 0.01). Participants who prefer the verbal risk description have a 17.6% greater financial experience than the participants who prefer the graphical risk description. On average the verbal group has a financial experience score of 3.88 (out of 6), while the graphical group has a score of 3.3. The observation indicates that investors who have more working experience in the financial sectors, consume more financial news, and have more trading experience, prefer a verbal scenario description of the return distribution. In contrast, less

experienced investors are more comfortable with a graphical description. A reason for the difference could be that financially experienced investors have fewer difficulties in understanding numerical information than unexperienced investors.[16] Furthermore, they may know from their experience that numerical information is often more exact than graphical information. In other words, financially experienced investors seem to know that the more objective the information is, the better the ambiguity is reduced, and the more appropriate the investment decision that can be made.

Figure 8: Average financial experience of the graphical and verbal group



Panel C of Table 6 shows that the graphical and verbal groups do not significantly differ regarding their age, gender, number of children, level of education, job position, income and wealth.

5.5 Behavioral differences between the graphical and verbal groups

In the following it is analyzed whether the graphical and verbal groups differ with regard to their risk tolerance, the attention given to the risk description and the effort made for the risk profiling tasks. In particular it is analyzed if the risk tolerance under ambiguity, the risk tolerance under risk as well as the effect of the reduction of the subjective ambiguity (via experience sampling) differs between the two groups. Furthermore it is analyzed if the graphical or verbal group spent more time to study their preferred risk description, to complete the risk profiling tasks, and to think about their investment decisions before they make them.

5.5.1 Decisions under ambiguity and risk

The first decision was made under ambiguity, as the graphical as well as the verbal groups had no information about the return distribution of the risky asset. The first decision is used to analyze if there is an ex ante difference in the risk tolerance between the two groups (i.e. controlling for the influence of the preferred risk description format). As Panel F in Table 6 shows, participants who prefer the verbal description take significantly more risk in their first decision (p-value < 0.01). The verbal group invests on average 41.93% of their endowment into the risky asset while the graphical group only

[16] Recall that the verbal description includes numerical information in the form of scenarios.

invests 31.83%. In other words, with the difference of 10.1 percentage points, the verbal group has a 24% higher risk tolerance. This finding is no surprise since in the sections 5.3 and 5.4.1 it is shown that the financial experience is a driver of risk tolerance, and that the financially experienced participants prefer the verbal risk description. Panel G in Table 6 further shows that both groups feel similar confidence with their first decision. The graphical group reaches on average a confidence score of 4.93 while the verbal group has on average a score of 5.13. The finding clearly indicates that participants who prefer the verbal description have a higher tolerance to ambiguity or are generally less risk averse than participants who prefer the graphical description. Without any information about the risky asset, the verbal group takes more risk than the graphical group.

After the first decision was made, the graphical as well as the verbal group studied the risk description. Both groups became informed and thus could move from making decisions under ambiguity, to decisions under risk. In order to compare the risk tolerance after the two groups studied the risk descriptions, the average risk tolerance of the investment decisions II to VI are analyzed. As Panel F in Table 6 shows, the difference observed in decision I continues for subsequent decisions. Participants who prefer the graphical risk description have a lower risk tolerance than those who prefer the verbal risk description. They invest on average 34.68% of their endowment into the risky asset while those who prefer the verbal risk descriptions invest 44.37%. In other words, with the difference of 9.69 percentage points, the verbal group has a 27% higher risk tolerance than the graphical group. The difference is highly significant on the 1% significance level. Panel G in Table 6 further shows that the graphical group has a confidence score of 5.06 and the verbal group has one of 5.19 which is not significantly different.

Combining the findings from the decisions under ambiguity and risk it can be concluded that participants who prefer the verbal risk description have in general a higher tolerance for ambiguity and risk. In addition, the risk tolerance of both groups moderately increases when they switch from a decision under ambiguity to a decision under risk (from 31.83% to 34.68% and 41.93% to 44.37% for the graphical and verbal groups respectively). The difference in risk tolerance (of approximately 10 percentage points) between the two groups remains highly constant over time, i.e. for all stages in the survey. Furthermore while both groups gave similar confidence scores with their investment decisions, the level of confidence slightly increased after the switch from ambiguity to risk (from 4.93 to 5.06 and 5.13 to 5.19 for the graphical and verbal groups respectively). The findings strongly indicate that the graphical and verbal groups were not differentially affected by the information in the risk descriptions.

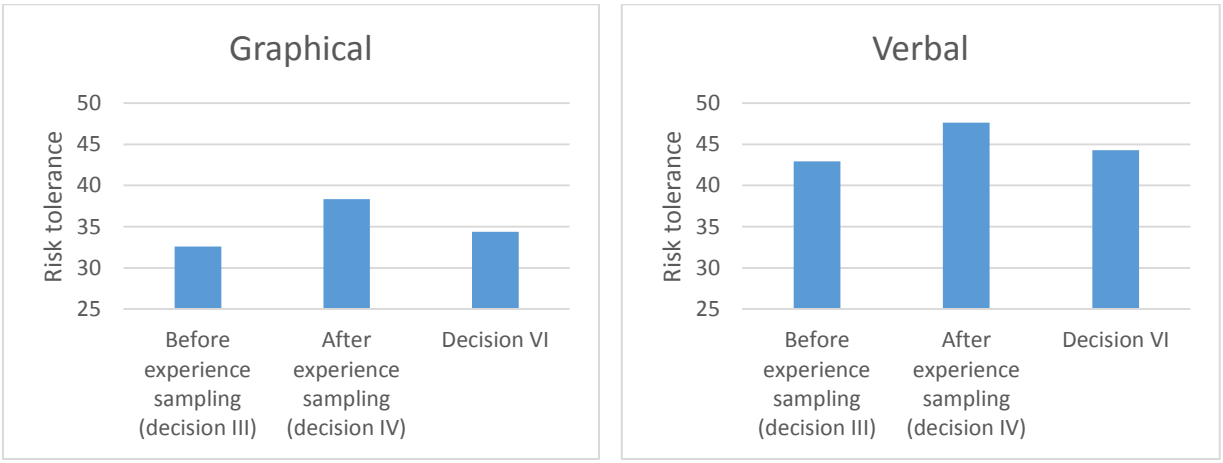
5.5.2 Reducing subjective ambiguity with experience sampling

Between the third and fourth investment decisions both groups had to complete the experience sampling task. As mentioned earlier, the task is intended to reduce the subjective ambiguity regarding the return distribution of different asset allocations. Although both groups know the return distribution

of the risky asset, the task may still reduce their subjective ambiguity, for example by helping them to get a better feeling for the known return distribution and how the distribution for the risky asset translates to the return distribution of an asset allocation. The reduction in the subjective ambiguity could be different, for example because one group already had a better understanding of the information included in the risk description, which could lower the effect of the experience sampling. Decision VI is again used to analyze how stable the effect of the experience sampling is.

Figure 9 shows the decisions III, IV and VI.[17] As can be seen, the graphical group takes significantly more risk after completing the experience sampling task (p-value < 0.01). Before the task they invested 32.6% of their endowment into the risky asset (decision III), and afterwards they invested 38.35% (decision IV). In other words, with the difference of 5.75 percentage points, the risk tolerance increased by 17.6%. Regarding the stability of the change, decision VI shows that the risk tolerance goes back to 34.4%. Therefore, the observed change is not very stable over time. Furthermore the graphical group feels slightly more confident after completing the experience sampling task (increase from 4.92 to 5.00), however the increase in confidence is not significant (see Panel B in Table 7).

Figure 9: Effect of experience sampling on subjective ambiguity (graphical vs. verbal)



In the case of the verbal group very similar results are found. Firstly, the risk tolerance significantly increases (p-value < 0.01) by 10.9% (from 42.95% to 47.64%). Secondly, the risk tolerance decreases again for decision VI to 44.29%, which shows that the change is not very stable over time. Last but not least, the verbal group feels slightly more confident with their investment decision after completing the task (it increases from 4.95 to 5.11), however, the increase is not significant (see Panel D in Table 7).

To conclude, after the experience sampling task both groups take significantly more risk. While the increase in risk tolerance was larger for the graphical group at 17.6% (compared to 10.9% for the verbal group), the effect was not particularly stable for either groups. Furthermore both groups feel

[17] For the exact numbers see Panel A and C in Table 7.

somewhat more confident in their investment decisions after completing the task, however the increase is not significant. Therefore, the reduction in the subjective ambiguity influences both groups about the same.

Table 6: Differences between participants who prefer the graphical or verbal risk description

	Graphical group	Verbal group	p-value (Mann-Whitney test)
A. Number of respondents	92	55	
B. Attention to risk description (effort)			
Time spent (in seconds)	0.20	0.29	0.0020
C. Financial experience and socioeconomic characteristics			
Financial experience (1=very low; 7=very high)	3.4	3.88	0.0034
Male	46	31	0.7726
Age	39.96	38.65	0.7682
Number of children	0.61	0.53	0.7183
Level of education (1=No education; 7=PhD)	3.67	3.49	0.5262
Job position (1=Apprentice; 7=Employee in top management)	3.17	3.24	0.3986
Level of income (1=0-1'300; 7=>18'000)	2.69	2.71	0.4324
Level of wealth (1=0-500; 7=>175'000)	3.6	3.6	0.4691
D. Attention to risk profiling tasks (effort)			
Time spent for experience sampling task (in seconds)	4.16	4.38	0.2456
Number of scenarios tested	274.67	250	0.6413
Number of different asset allocations tested	6.41	6.51	0.5643
Time spent for remaining risk profiling tasks (in seconds)	19.25	20.57	0.1092
E. Attention to investment decision (effort)			
Time spent (in seconds)	0.33	0.35	0.1073
F. Risk tolerance			
Decision I	31.83%	41.93%	0.0090
Ø Decision II-VI	34.68%	44.37%	0.0090
G. Confidence with investment decision(s)			
Decision I	4.93	5.13	0.3176
Ø Decision II-VI	5.06	5.19	0.2373

Table 7: Effect of experience sampling on subjective ambiguity (graphical vs. verbal)

	Before experiene sampling (decision III)	After experiene sampling (decision IV)	Decision VI	p-value (Mann-Whitney test) Before vs. After
Graphical				
A. Risk tolerance	32.6	38.35	34.4	0.0001
% of risky asset hold in the portfolio				
B. Confidence				
Index (1=very low; 7=very high)	4.92	5	5.21	0.2765
Verbal				
C. Risk tolerance				
% of risky asset hold in the portfolio	42.95	47.64	44.29	0.0049
D. Confidence				
Index (1=very low; 7=very high)	4.95	5.11	5.44	0.1550

5.5.3 Effort exerted

With regard to the effort exerted to complete the different risk profiling tasks and to think about the investment decisions, no significant differences between the two groups could be found. As Panels D and E in Table 6 show, the participants of the graphical group spent on average 4 minutes and 16 seconds to complete the experience sampling task, sampled 275 scenarios, and tested 6 different asset allocations. In the case of the verbal group they spent 4 minutes and 38 seconds to complete the experience sampling task, sampled 250 scenarios, and tested 6 different asset allocations. Regarding the time spent for the remaining risk profiling tasks, the graphical group spent on average 19 minutes and 25 seconds while the verbal group spent 20 minutes and 57 seconds. The time spent to think about the investment decision is also very similar for both groups (on average 33 seconds for the graphical group and 35 seconds for the verbal group).

5.5.4 Attention to the risk descriptions

In the following it is analyzed how much time the graphical and verbal groups spent to study their preferred risk description format. Remember that the amount of time the participants studied the description for the first time is not taken into account for the analysis. This exclusion is to ensure that any difference in time caused by difficulty in understanding a given format does not confound the results.

As Panel B in Table 6 shows, the participants who prefer the verbal description study the risk description significantly longer than those who prefer the graphical description (p-value < 0.01). On average, the graphical group spent 20 seconds to read their preferred description, while the verbal group spent 29 seconds. In other words, with the difference of 9 seconds, the verbal group studies the preferred risk description 45% longer. The big difference in time suggests that the verbal group thinks hard about the information in the description, e.g. what the numbers and scenarios imply for the outcome of their investment decision.

5.6 Explaining risk tolerance with risk description format, financial experience, and effort

The descriptive analysis so far shows that the participants of the verbal group have more financial experience, a higher risk tolerance, and that they spend more time to study their preferred risk description when compared to the graphical group. In the following it is analyzed if the financial experience, the preferred risk description format as well as the effort (i.e. time spent) can explain the risk tolerance.

For the analysis, a multiple linear regression is made. As the dependent variable the average risk tolerance of the decisions II-VI is taken (i.e. the decisions under risk). The independent variables are a

dummy variable for the preferred risk description format, the financial experience (continuous variable), and the effort (measured as total time spent) on the survey. [18]

$$\emptyset\, risk\ tolerance\ =\ \alpha + \beta_1 dummyFormat + \beta_2 financial\ experience + \beta_3 effort + e$$

As Panel B in Table 5 shows, the intercept is highly significant (p-value < 0.01) and has a value of 20.62%. The dummy variable for the risk description format is also significant (p-value < 0.05). Participants who prefer the verbal description invest on average 7.7 percentage points more of their endowment into the risky asset than those who prefer the graphical description. Furthermore the results show that financial experience is positively and significantly related to the risk tolerance (p-value < 0.01). A one unit increase in the financial experience leads to an increase of 4.15 percentage points in the risk tolerance. With regard to the effort no significant relationships could be found.[19] The adjusted R-squared is 8.15% without the control variables, and 16.63% with the control variables. However, as the results of the regression analysis with the control variables shows, only the financial experience stays significant.

Of the variables tested, the difference in financial experience drives the difference in risk tolerance, not the choice of risk description format (e.g. verbal or graphical). Although the choice of risk description format is not important, it is important to study a risk description (as the comparison between the attentive and non-attentive participants shows).

6 Discussion

Financially illiterate investors are less likely to follow advice (Lusardi & Mitchell (2011), Van Rooij et al. (2011), Collins (2012)). I additionally find that financially inexperienced investors are also less likely to inform themselves even when incentivized to do so, and hence the term non-attentive. In other words, not only is it difficult to offer advice that is followed by these investors, it is difficult to reach and get their attention in the first place. The implication is that these investors are left to rely on their own uninformed judgement. This often means not investing at all or too little in high risk, high potential return investments. Unfortunately, this combination of propensities perpetuates a situation where the "poor get poorer and the rich get richer", also referred to as the "Matthew effect" in sociology (Merton (1968)).

Most probably financial experience and financial literacy are related, as mentioned by Van Rooij et al. (2011), and so it is to no surpise that our results coincide that of the existing literature which measures financial literacy instead of experience. Participants with more financial experience invest significantly more of their wealth into the risky assets, and are thus less prone to investing

[18] The interaction terms between the dummy variable and the independent variables financial experience and effort were analyzed. The presented model best fit the data.

[19] While there is a significant difference in effort between attentive and non-attentive participants, there is no such significant difference between the graphical and verbal groups. In other words attentive participants exert a similar degree of effort, independent of the risk description format they prefer.

inefficiently; this is in agreement with the results of Van Rooij et al. (2011) and Kimball & Shumway (2010) regarding illiteracy. With regard to the socioeconomic factors, similar results are found to Hackethal et al. (2012). Participants who are willing to inform themselves (attentive participants) have a higher education as well as income and wealth.

This situation leads not only to significant forgone returns to both investor and advisor, but it is also socially unfortunate. Financially illiterate investors will have less savings accummulated to meet their retirement needs (Lusardi & Mitchell (2007)). Needless to say, the aformentioned insights provided by the literature and the current paper are highly relevant to regulatory and policymaking organisations, who have social objectives, and who's efforts have in recent years been focused on making standardized information available. Even if this information is easy to access, unbiased, free of monetary and non-monetary costs, it would be ignored by the investors they are intended for. To use an idiom, the information falls on deaf ears. There may however be other avenues to better reach these non-attentive investors.

The favorable results of this paper suggest a possible means of not only reaching but also nudging the behavior of non-attentive investors through a mandatory risk profiling task: experience sampling. While introducing such a task at financial advisory firms is a possible remedy, it risks the appearance (and possibly reality) of containing biases resulting from conflicts of interest. The other distinct disadvantage of this avenue is that it may not even reach the non-attentive investors: Van Rooij et al. (2011) find that financially illiterate investors are less likely to use formal sources (newspapers, financial advisors), and Lusardi & Mitchell (2011) show that financially illiterate investors are less likely to use formal tools for investment decisions, and more likely to use informal sources (talking to family, friends, coworkers).

Another avenue for further research to explore is the possibility of including such mandatory exercises as a part of the education system. Several authors have also suggested financial education, such as Van Rooij et al. (2011), Guiso & Jappelli (2008), Kimball & Shumway (2010). Given the preference for informal sources, an experience sampling like exercise could no doubt be implemented with a game or competition.

Similar to Weber et al. (2005), Fagerlin et al. (2007), and Visschers et al. (2009), the results of this study also suggest the use of multiple description forms. The less experienced investors prefer the graphical form, while the more experienced investors prefer the verbal form. The content of the verbal form is similar to the forms recommended by Visschers et al. (2009) and Fagerlin et al. (2007), as it contains frequency information. Multiple forms, such as the graphical and verbal forms researched herein, could likewise be built into the proposed education.

7 Conclusion

Non-monetary costs and the comprehensibility of financial information are not the reasons why so many investors are reluctant to willingly become informed. Although the participants are financially incentivized to make an informed decision, and are offered information which is (1) very easy to access (clicking on a link), (2) free, (3) causes no further non-monetary costs, (4) unbiased, (5) offered in three different risk description formats (increasing the comprehensibility), more than half of them do not access the information. A comparison between the participants who access the information, and those who do not, shows that the two kinds of investors can be described as attentive and non-attentive. The attentive investors are intrinsically motivated to reach for financial information. They are also willing to put effort into completing different kinds of risk profiling tasks. In contrast, non-attentive investors are reluctant to receive any financial information, and they put a minimal effort in doing other risk profiling tasks. Attentive investors are financially more experienced, have a higher education and income, more wealth, and a higher risk tolerance than non-attentive investors.

As an extension to the results of Bhattacharya et al. (2012) that those who would most benefit from financial advice are the least likely to accept it, the results of this paper show that those who would most benefit from becoming informed investors, are not willing to do so. One possibility to reduce this grievance is to nudge investors to do what is good for them. In order to test this idea, a mandatory experience sampling task is included in the survey design. As the results indicate, especially non-attentive investors benefit from being nudged. They consistently invest more into risky assets after having completed the experience sampling task, which has the effect of increasing their risk tolerance. Thus the mandatory task successfully helps them consistently reduce the inefficiency of their decisions by investing more into risky assets. On the other hand, no consistent change in the behavior of the attentive investors could be observed. The data indicates that the attentive participants follow some simple heuristics to make their investment decisions. In particular, they seem to have a preconception about how much they want to invest into the risky assets, which is most probably based on their past experience. This preconception is like an anchor for their future investment decisions, from which they hardly deviate. This observation may also explain why the mandatory experience sampling task cannot consistently change their investment behavior.

The study further shows that different kinds of investors prefer different kinds of risk description formats. In order to make the offered information as comprehensible as possible, participants could access the information in three different risk description formats (graphical, verbal and statistical). While the more financially experienced and risk tolerant participants prefer the verbal description, the less financially experienced and risk tolerant participants prefer the graphical description. The statistical description is preferred by only a few participants and is therefore not analyzed further in this study. The data also shows that participants who prefer the verbal description put more effort into studying the information than participants who prefer the graphical description. Last but not least, the

risk tolerance of the participants could be best explained by their financial experience. This and the other findings of the study indicate that the financial experience is a good indicator for the financial behavior of investors. It seems that the financially experienced investors know what they have to do to make a good investment decision, while the financially unexperienced investors have to be nudged to do what is good for them.

For the financial industry the findings have several implications. Despite the efforts exerted to provide investors with unbiased information in standardized formats (e.g. a key information investor document (KIID)), this information only reaches those investors who are already willing to become informed (attentive investors). As such, the hope of the regulators that more investors will accept financial advice (or even information) when it is free and unbiased probably goes unfulfilled. More efforts need to be made to reach the non-attentive investors, who would benefit most from the support of regulators and financial advisors. Furthermore, attentive investors follow some simple heuristics to make their investment decisions, and while heuristics are per se not unconstructive, they should still be monitored by an advisor in order to insure that the investor act in his/her best interest. In addition, different risk description formats should be made available and used by financial advisors and regulators to present financial information. Of all the above implications, the most significant challenge will be to find ways to better nudge non-attentive investors to do what is good for them.

Appendix

Financial Experience and Knowledge Questions

Consumption of Financial News

I am very interest in economic news

Not True at all ◉ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 Absolutely true

Financial Knowledge

I can explain to a friend very well at which things he/she has to look after in the case of risky financial assets.

Not True at all ◉ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 Absolutely true

Statistical Knowledge

I can explain to a friend very well what a probability distribution is.

Not True at all ◉ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 Absolutely true

Financial Trading Experience

Since how many years do you trade financial asset by yourself?

- ○ I have never traded financial assets by myself
- ◉ I buy and sell financial assets since about 1 to 3 years.
- ○ I buy and sell financial assets since about 4 to 6 years.
- ○ I buy and sell financial assets since about 7 to 9 years.
- ○ I buy and sell financial assets since about 10 to 12 years.
- ○ I buy and sell financial assets since about 13 to 15 years.
- ○ I buy and sell financial assets since more than 15 years.

Trading Frequency

How many times do you reallocate your financial assets, i.e. how often do you buy and sell financial assets?

- (●) Not at all
- ( ) About every second year
- ( ) About once a year
- ( ) About twice a year
- ( ) About four times a year
- ( ) About every month
- ( ) At least once a week

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